

MEMORANDUM TO: Brian Lorenc
GHB-630, LLC

FROM: Michael A. Werthmann, PE, PTOE
Principal

Luay R. Aboona, PE
Principal

DATE: May 27, 2011 - **Revised October 20, 2011**

SUBJECT: Traffic Impact Study
410 East Grand Avenue
Chicago, Illinois

This memorandum summarizes the methodologies, results, and findings of a traffic impact study conducted by Kenig, Lindgren, O'Hara, Aboona, Inc. (KLOA, Inc.) for a proposed mixed-use development to be located in Chicago, Illinois. The site, which currently contains a surface parking lot, is located on the east side of McClurg Court bounded by Ohio Street on the north and Grand Avenue on the south. As proposed, the development is to consist of 488 apartments, approximately 9,000 square feet of commercial space, approximately 69,800 square feet of professional office space and a 294-space parking garage. Access to the parking garage and service area is proposed to be provided on Ohio Street and Grand Avenue.

The purpose of this study was to examine background traffic conditions, assess the impact that the proposed development will have on traffic conditions in the area, and determine if any street or access improvements are necessary to accommodate traffic generated by the development.

The sections of this report present the following.

- Existing conditions
- A description of the proposed development
- Directional distribution of the development generated traffic
- Vehicle trip generation for the proposed development
- Future traffic conditions including access to the site
- Traffic analyses for the weekday morning, weekday evening and Saturday midday peak hours
- Recommendations with respect to adequacy of the site access system and adjacent street network

Existing Conditions

Existing transportation conditions in the vicinity of the site were documented based on a field visits conducted by KLOA, Inc. in order to obtain a database for projecting future conditions. The following provides a description of the geographical location of the site, physical characteristics of the area street system including lane usage and traffic control devices, an inventory of the alternative modes of transportation serving the area and existing peak hour vehicle and pedestrian volumes.

Site Location

The site, which currently contains a public parking lot with approximately 182 spaces, is bounded by Ohio Street on the north, Lake Shore Plaza to the east, Grand Avenue on the south, and McClurg Court on the west. Land uses in the immediate area consist primarily of residential, office, hotel, and retail land uses. **Figure 1** shows an aerial photo of the site.

Area Streets

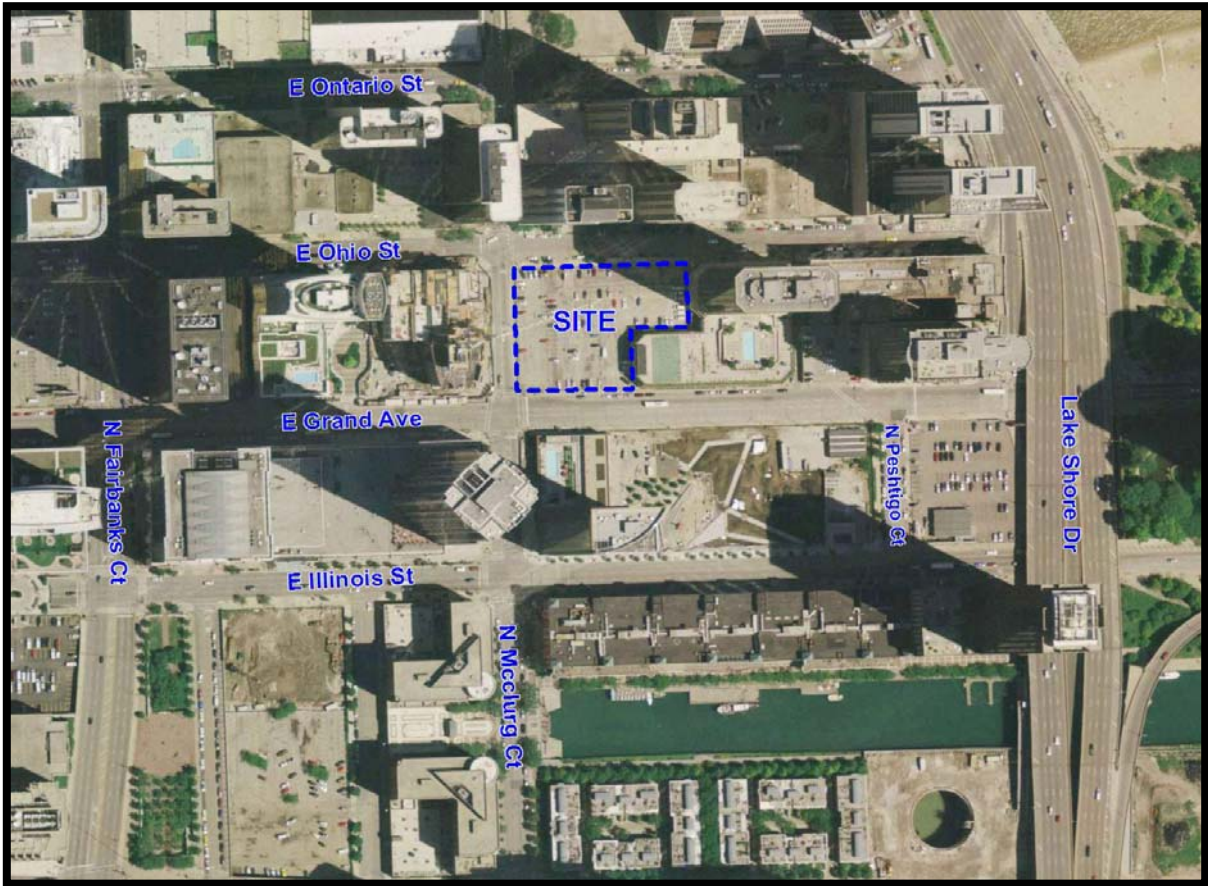
The principal streets in the site vicinity that provide access to the site are described in the following paragraphs and shown in **Figures 2** and **3**.

Ohio Street is a major one-way eastbound arterial street that forms a one-way pair with Ontario Street. The Ohio-Ontario pair provides direct access to/from the Kennedy Expressway (I-94) via the Ohio Street feeder ramp. Ohio Street generally has three moving lanes, with parking permitted on both sides of the street. Traffic signals are located at most intersections along Ohio Street including the intersections of Columbus Drive and McClurg Court.

Illinois Street is a major one-way eastbound arterial street that forms a one-way pair with Grand Avenue. The Illinois-Grand pair provides direct access to/from Lake Shore Drive via the Illinois Street, Grand Avenue, and Lake Shore Drive interchange. Between Columbus Drive and Lower Lake Shore Drive, Illinois Street has three moving lanes with parking generally prohibited on both sides of the street. Traffic signals are located at most intersections along Illinois Street including the intersections of Columbus Dr, McClurg Ct, Peshtigo Ct, and Lower Lake Shore Drive.

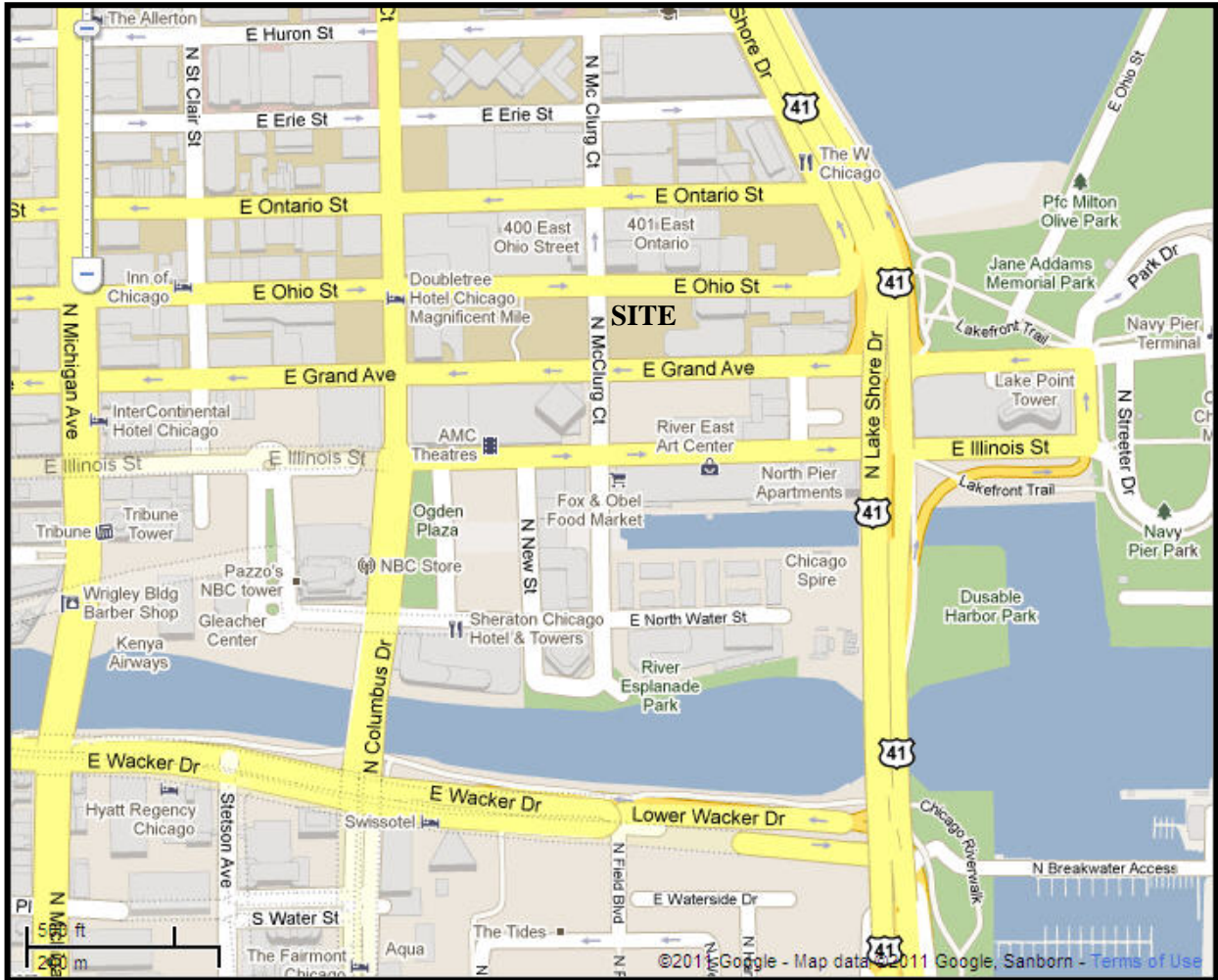
Grand Avenue is a major one-way westbound arterial street that forms a one-way pair with Illinois Street. Between Lake Shore Drive and Columbus Drive, Grand Avenue has four moving lanes with parking generally permitted on the north side of the street and prohibited on the south side of the street. Traffic signals are located at most intersections along Grand Avenue, including the intersections of Lower Lake Shore Drive, Peshtigo Court, McClurg Court, and Columbus Drive.

McClurg Court is a north-south, local street that extends from Huron Street south to River Drive. McClurg Court is generally a two-way street except the section between Ontario Street and Ohio Street, which is a one-way northbound street. Parking is generally prohibited on both sides of McClurg Court except south of Illinois Street and on the west side of the street between Ohio Street and Grand Avenue.



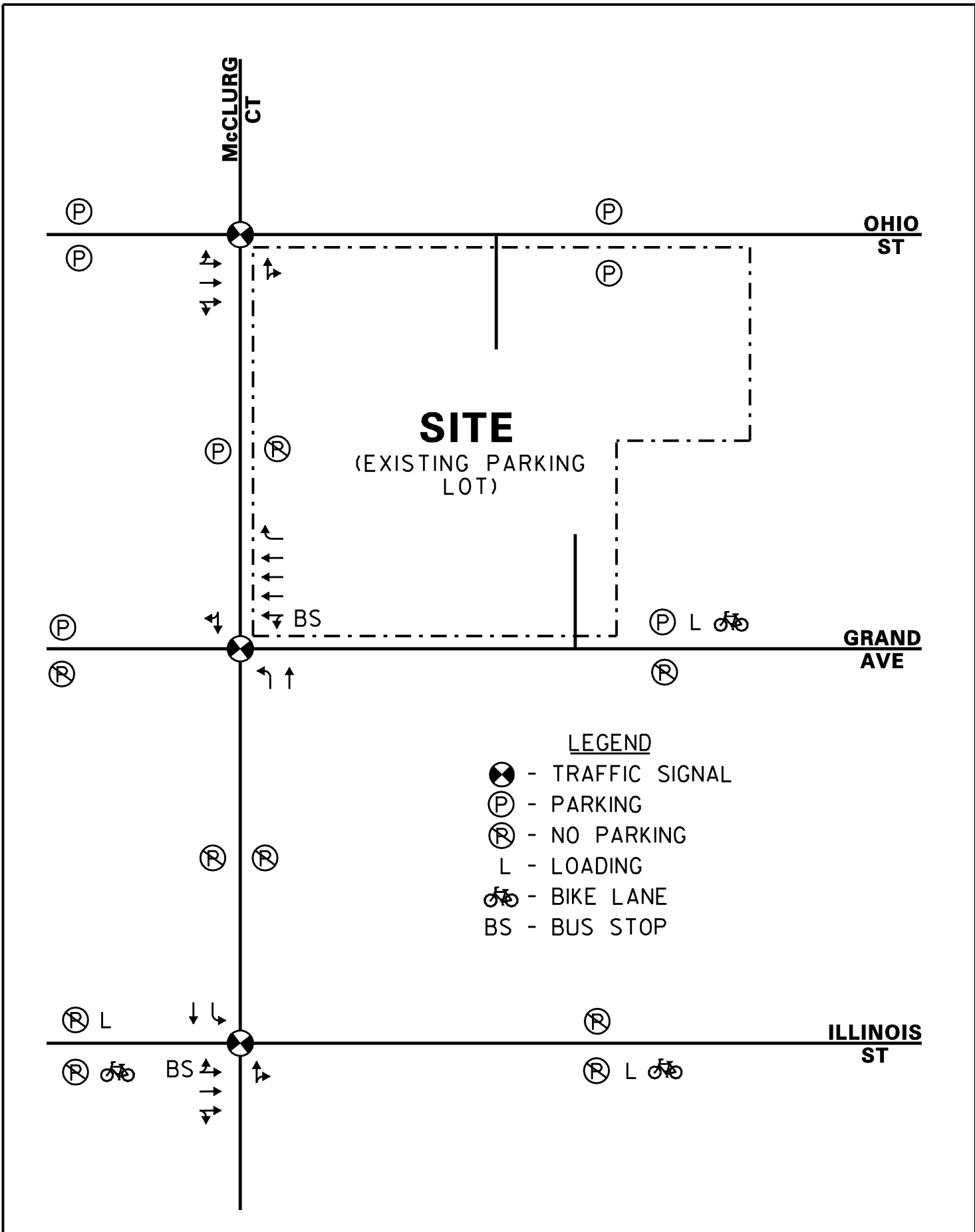
Site Location

Figure 1



Area Street System

Figure 2



PROJECT:
410 EAST GRAND
CHICAGO, ILLINOIS

TITLE:
EXISTING STREET CONDITIONS

PROJECT NO: II-050

KLOA

FIGURE NO: 3

Alternative Modes of Transportation

Accessibility to and from the area is enhanced by the various alternative modes of transportation serving the area as summarized below.

Public Transportation. The area is served by the CTA Red (Howard/Dan Ryan) rapid transit line which extends from the Howard Street station located on the City's northern border to the 95th/Dan Ryan station located along the Dan Ryan Expressway at 95th Street. A local stop is provided at State Street and Grand Avenue (Grand Avenue Station) which is located approximately ½ mile from the site. In addition, the following bus routes serve the immediate area and all have stops adjacent to the site.

- *Route Number 2 - Hyde Park Express* generally runs along Lake Shore Drive, State Street and Michigan Avenue between Hyde Park and the River North and Streeterville neighborhoods. Service is provided Monday through Friday during the morning and evening peak periods.
- *Route Number 29 - State* generally runs along State Street between the Red Line's 95th/Dan Ryan station and the Illinois/Grand corridor. Service is provided seven days a week and on holidays.
- *Route Number 65 - Grand* generally runs along Grand Avenue between Navy Pier and Nordic Avenue (7000 West Grand Avenue). Service is provided seven days a week and on holidays.
- *Route Number 66 - Chicago* generally runs along Chicago Avenue between Navy Pier and Austin Avenue (6000 West Chicago Street). Service is provided seven days a week and on Holidays.
- *Route Number 120 - Ogilvie/Wacker Express* generally runs along Wacker Drive and the Illinois/Grand corridor between the Ogilvie Metra Station and Navy Pier. Service is provided Monday through Friday during the morning and evening peak periods.
- *Route Number 121 - Union/Wacker Express* generally runs along Wacker Drive and the Illinois/Grand corridor between the Union Station and Navy Pier. Service is provided Monday through Friday during the morning and evening peak periods.
- *Route Number 124 - Navy Pier* runs along Wacker Drive, Illinois Street, Grand Avenue and Madison Street between Navy Pier and Ogilvie and Union Stations. Service is provided seven days a week and on Holidays.

Lastly, numerous additional bus routes run along Michigan Avenue with bus stops located within walking distance of the project.

Bicycle Routes. The following streets within the vicinity of the site have been recommended as bike routes by the Chicago Department of Transportation (CDOT).

- Both Illinois Street and Grand Avenue between Navy Pier/Lakeside Trail and Wells Street with bike lanes provided along both streets.
- McClurg Court between Illinois Street and Ohio Street.
- Ohio Street between McClurg Court and the pedestrian underpass under Lake Shore Drive.

Lastly, the Lakefront Trail is located less than a quarter of a mile from the site and extends along Lake Michigan for 18 miles between Hollywood Avenue on the north and 71st Street on the south. The Grand Avenue and Illinois Street bike lanes provide direct access between the site and the Lake Front Trail. It should be noted that (CDOT) is planning to grade separate the Lake Front Trail over the Chicago River and Lower Lake Shore Drive. The Navy Pier Flyover is proposed to run along the eastern edge of Lake Shore Drive extending from just south of the river to just north of Jane Addams Memorial Park. According to the CDOT, construction could begin as soon as 2012.

Pedestrian Facilities. All of the streets within the immediate area have sidewalks on both sides of the street. In addition, as previously noted, the Lakefront Trail is located less than a quarter of a mile from the site. Lastly, crosswalks and pedestrian traffic signals are generally provided at all of the intersections within the immediate area, with countdown pedestrian traffic signals provided at the intersections of Grand Avenue/McClurg Court and Illinois Street/McClurg Court.

Year 2000 census data (see Appendix) and surveys conducted by the Illinois-Grand Transportation Management Association (TMA) have shown that only approximately 33 percent of the residents within the southern portion of Streeterville drive a car to work. The majority of the residents within the area use the alternative forms of transportation to commute to/from work. Therefore, the proximity of Streeterville within the downtown area and the alternative forms of transportation serving the area has resulted in a significant reduction in the traffic generated by area residential developments, particularly during the critical weekday morning and evening commuter peak periods.

Existing Traffic Volumes

In order to determine current traffic conditions in the vicinity of the site, KLOA, Inc. conducted peak period vehicle and pedestrian counts at the following intersections.

- Ohio Street with McClurg Court
- Grand Avenue with McClurg Court
- Illinois Street with McClurg Court
- Ohio Street with the access drive serving the parking lot located on the subject site
- Grand Avenue with the access drive serving the parking lot located on the subject site

The traffic counts were conducted on Thursday, April 7, 2011 during the morning (7:00 A.M. to 9:00 A.M.) evening (4:00 P.M. to 6:00 P.M.) peak periods and on Saturday,

April 9, 2011 during the midday (Noon to 2:00 P.M.) peak period. Based on the results of the traffic counts, the weekday morning peak hour of traffic occurs from 8:00 A.M. to 9:00 A.M., the weekday evening peak hour of traffic occurs from 5:00 P.M. to 6:00 P.M., and the Saturday midday peak hour occurs from 12:30 P.M. to 1:30 P.M. It should be noted that the updated traffic volumes were compared with previous traffic counts conducted by KLOA, Inc. To provide a conservative (worst case) analysis, the highest traffic volume for each movement and each time period were generally used for this study. **Figure 4** illustrates the existing peak hour traffic volumes and **Figure 5** illustrates the existing pedestrian volumes.

Traffic Characteristics of the Proposed Development

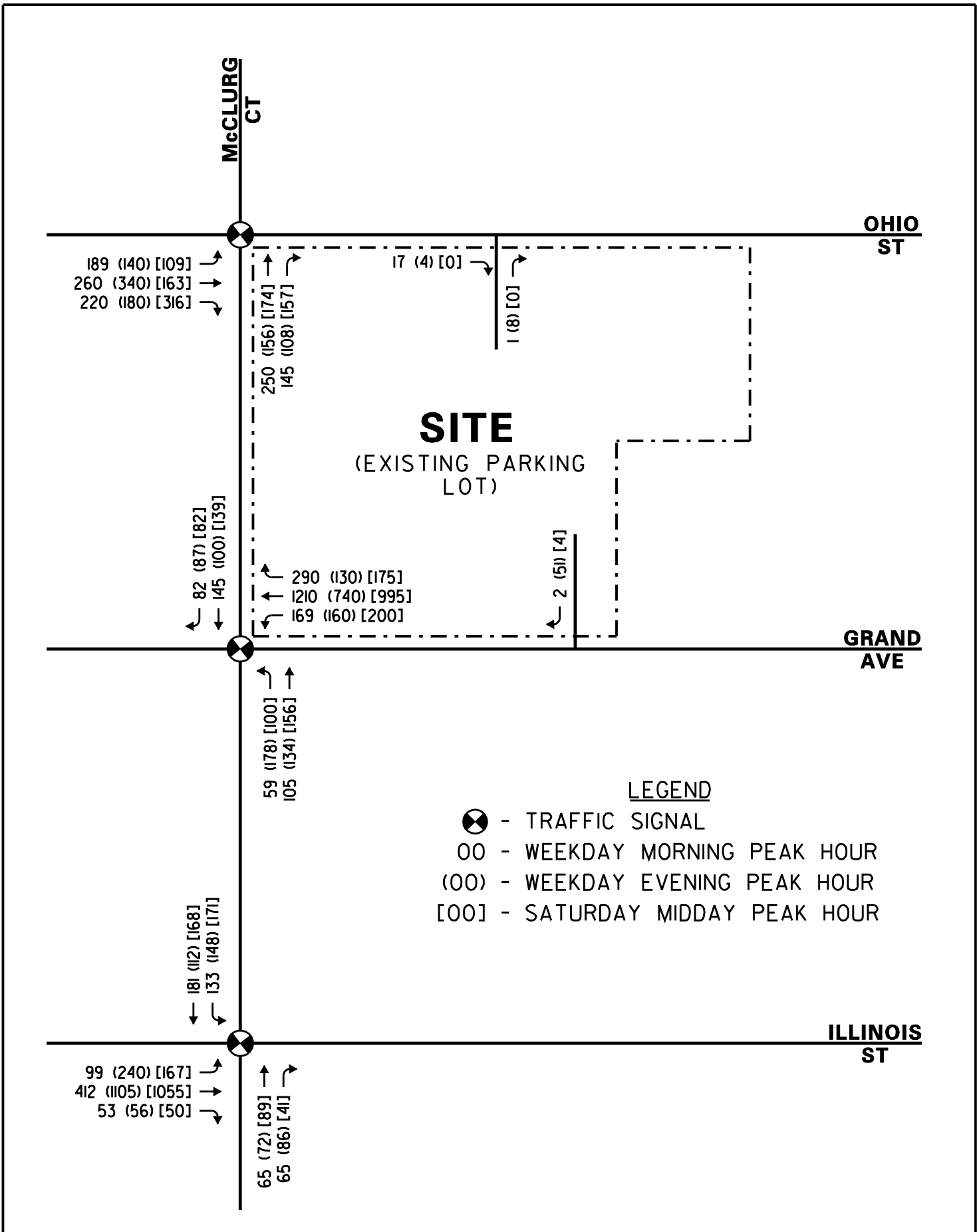
In order to properly evaluate future traffic conditions in the surrounding area, it was necessary to determine the traffic characteristics of the proposed development including the directional distribution and volumes of traffic that it will generate.

Proposed Development Plan

As proposed, the development is to consist of 488 apartments, approximately 9,000 square feet of commercial space, approximately 69,800 square feet of professional office space, and a 294-space parking garage. Access to the parking garage is proposed to be provided via an inbound only access drive on Ohio Street and an inbound and outbound access drive on Grand Avenue. All service loading will occur internally and will be provided via a one-way southbound service drive that will extend from Ohio Street to Grand Avenue. Lastly, a drop-off/pick-up lane is proposed to be provided along McClurg Court.

Directional Distribution of Site Traffic

The directions from which the development-generated traffic will approach and depart the site were estimated based on the existing travel patterns as determined from the traffic counts and previous studies conducted in the area. **Figure 6** illustrates the directional distribution for the development.



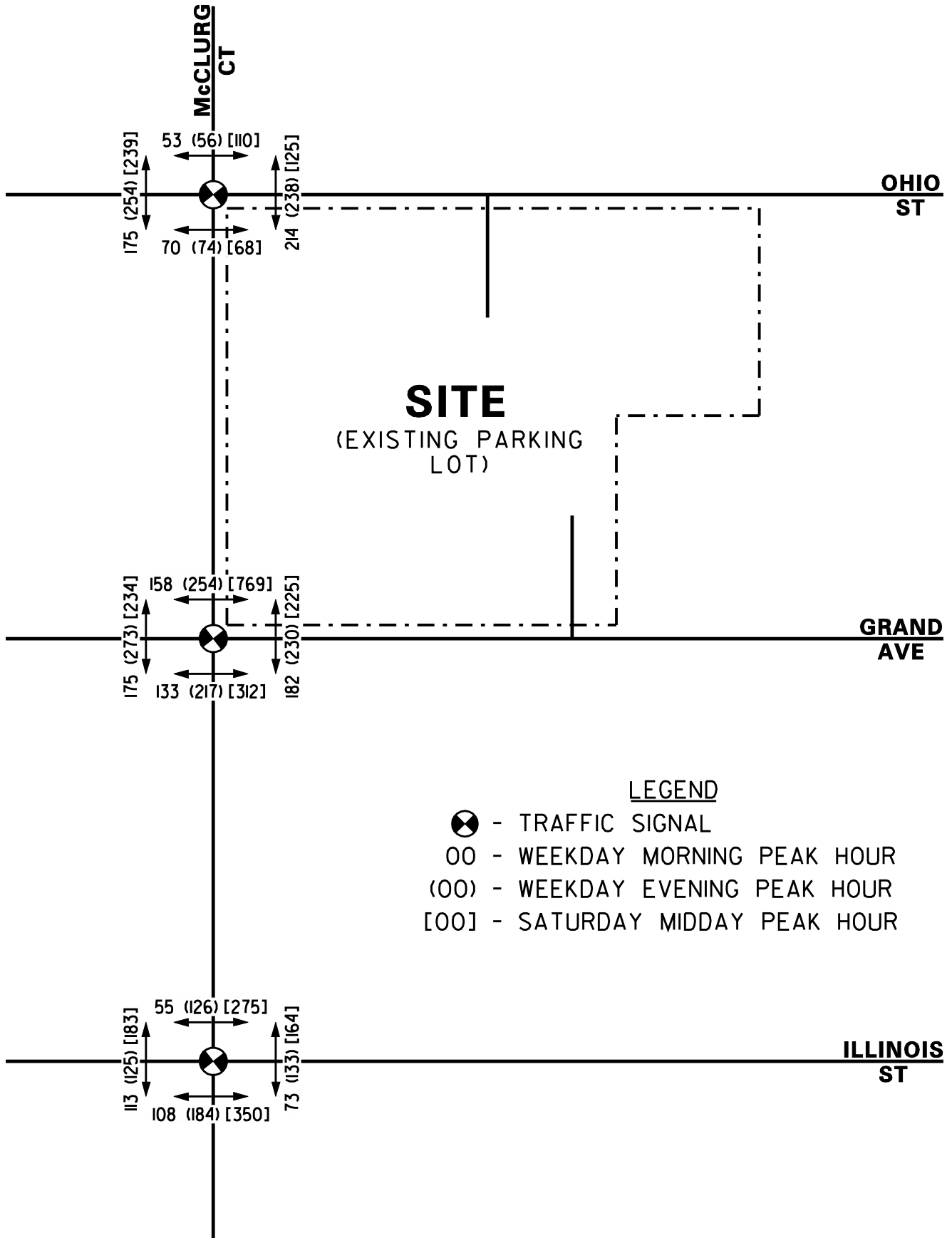
PROJECT:
410 EAST GRAND
CHICAGO, ILLINOIS

TITLE:
EXISTING PEAK HOUR
VEHICULAR VOLUMES

PROJECT NO: II-050

KLOA

FIGURE NO: 4



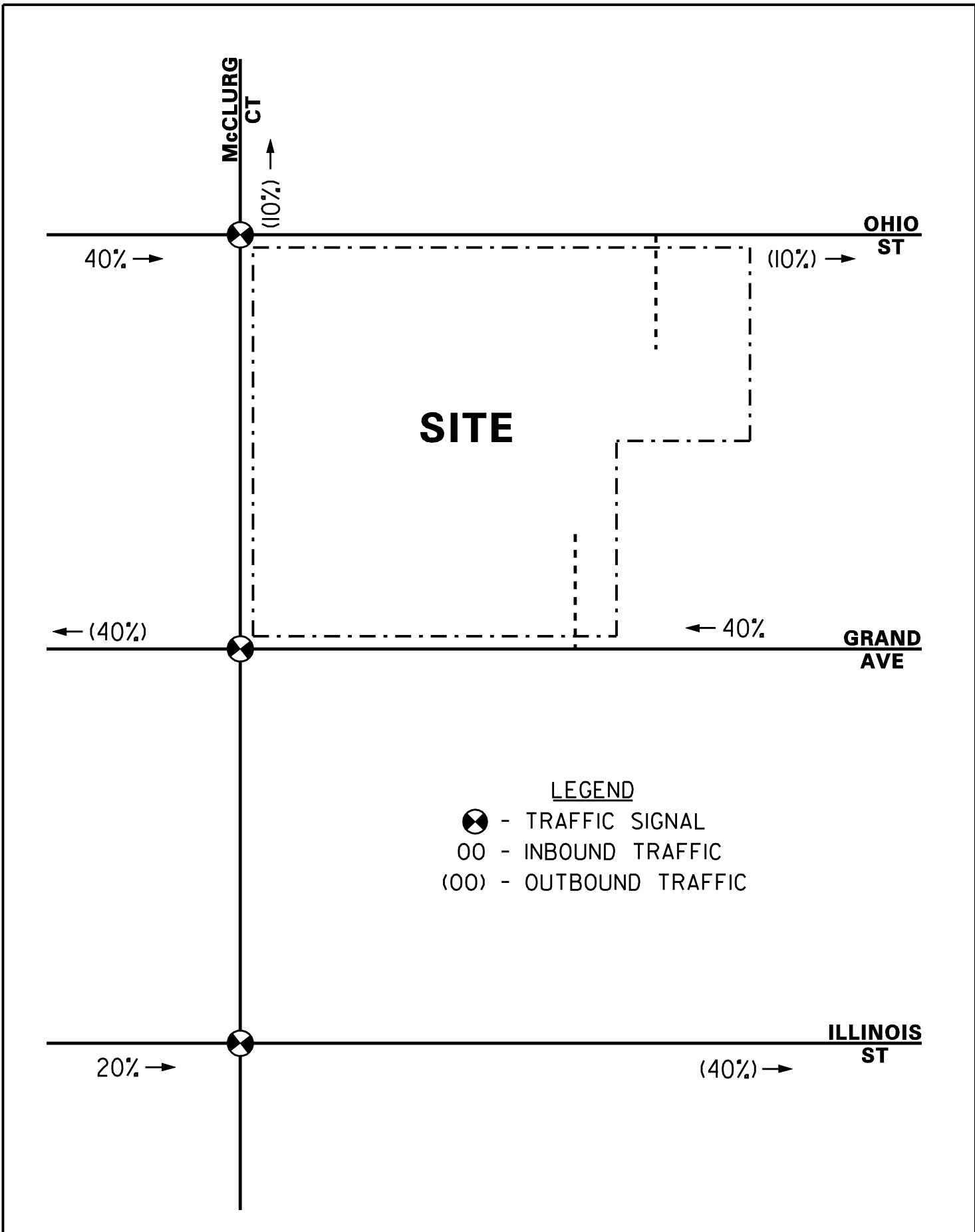
PROJECT:
410 EAST GRAND
CHICAGO, ILLINOIS

TITLE:
EXISTING PEAK HOUR
PEDESTRIAN VOLUMES

PROJECT NO: II-050

KLOA

FIGURE NO: 5



| | | |
|---|---|--|
| <p>PROJECT:</p> <p>410 EAST GRAND CHICAGO, ILLINOIS</p> | <p>TITLE:</p> <p>DIRECTIONAL DISTRIBUTION</p> | <p>PROJECT NO: II-050</p> <p style="text-align: center;">KLOA</p> <p>FIGURE NO: 6</p> |
|---|---|--|

Site Traffic Generation

The peak hour traffic volumes that will be generated by the apartments were estimated based on the Apartment (Land-Use Code 220) Specialty Retail Center (Land-Use Code 814) and Medical-Dental Office Building (Land-Use Code 720) trip rates provided in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 8th Edition. However, the traffic estimated to be generated by the development was based on suburban rates where the primary mode of transportation is the automobile. Therefore, given the location of the development within a dense, urban area and its proximity to alternative modes of transportation, the estimated number of trips generated by the residential and retail components of the development and was reduced by 67 percent while the number of trips that will be generated by the professional office building was reduced by 50 percent. **Table 1** shows the estimated peak hour traffic to be generated by the proposed development.

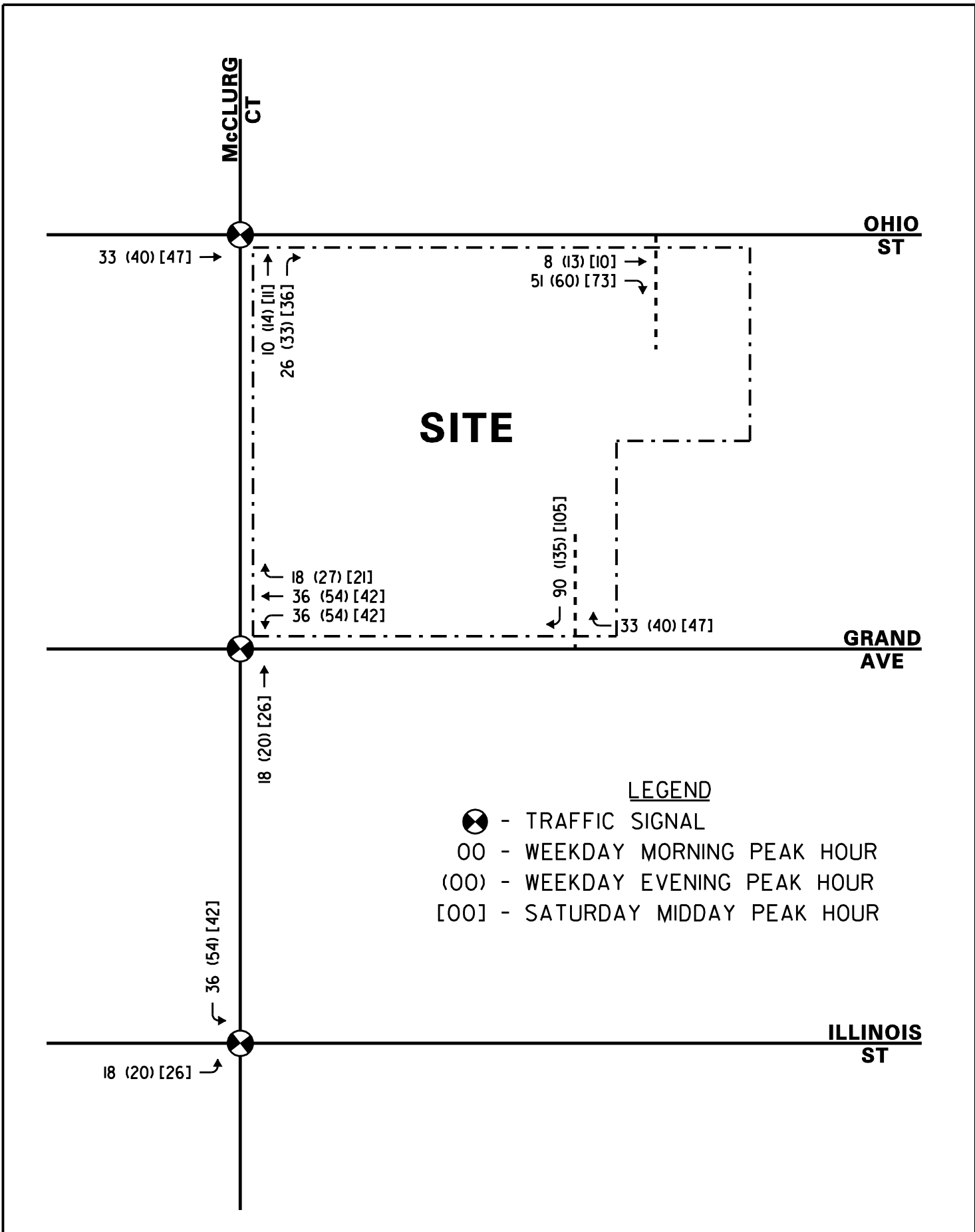
Table 1
PROJECTED SITE-GENERATED TRAFFIC VOLUMES

| Land Use | Weekday Morning Peak Hour | | Weekday Evening Peak Hour | | Saturday Midday Peak Hour | |
|---------------------|------------------------------|----------|------------------------------|-----------|------------------------------|-----------|
| | In | Out | In | Out | In | Out |
| Apartments | 15 | 65 | 60 | 35 | 35 | 35 |
| Professional Office | 65 | 20 | 30 | 85 | 70 | 55 |
| Commercial Space | <u>5</u> | <u>5</u> | <u>10</u> | <u>15</u> | <u>15</u> | <u>15</u> |
| Total | 85 | 90 | 100 | 135 | 120 | 105 |

It should be noted that the site contains an approximate 182-space parking lot that is currently generating traffic. Therefore, the traffic projected to be generated by the proposed development will not be all new traffic to the area as it will be replacing the existing parking lot. However, to provide a worst case analysis, the total development-generated trips were not reduced to account for the traffic generated by the existing public parking lot.

Projected Traffic Volumes

The estimated peak hour traffic volumes that will be generated by the proposed development were assigned to the street system in accordance with the previously described directional distribution. **Figure 7** illustrates the development generated traffic volumes. In addition to the development-generated traffic, the study also included the traffic that will be generated by the following developments proposed in the area.



| | | |
|---|---|--|
| <p>PROJECT:</p> <p>410 EAST GRAND CHICAGO, ILLINOIS</p> | <p>TITLE:</p> <p>SITE-GENERATED PEAK HOUR VOLUMES</p> | <p>PROJECT NO: II-050</p> <p>KLOA</p> <p>FIGURE NO: 7</p> |
|---|---|--|

- The proposed apartment development to be located on the east side of Peshtigo Court between Grand Avenue and Illinois Street.
- The second residential tower proposed for the Parkview West development to be located on the west side of Peshtigo Court between Grand Avenue and Illinois Street.
- The proposed Northwestern Memorial Hospital Parking Garage to be located between Ontario Street and Ohio Street just east of the site.

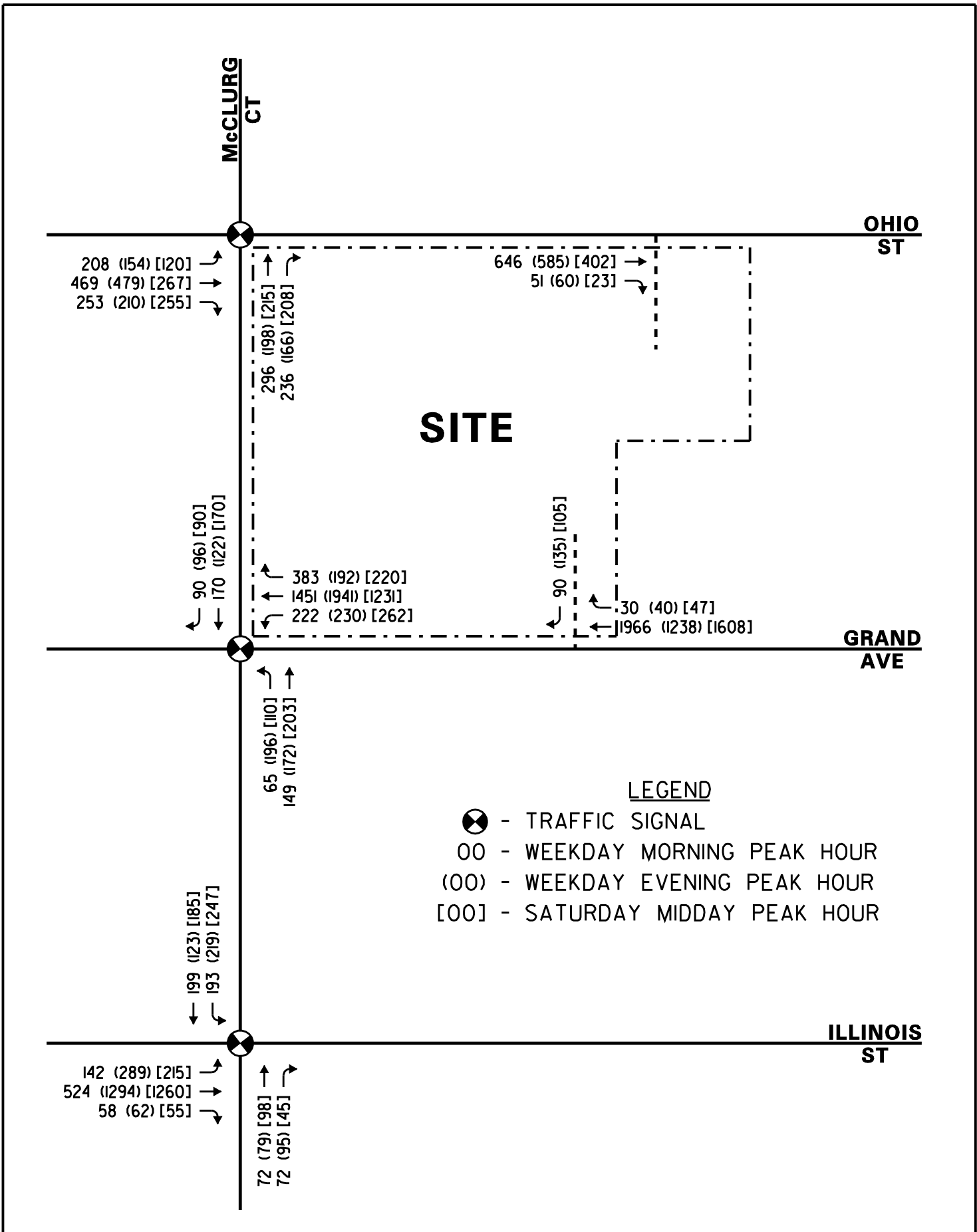
Further, to account for other growth in the area, the existing traffic volumes were increased by ten percent. **Figure 8** shows the total peak hour volumes which include the existing traffic volumes, the development-generated traffic volumes and other growth projected in the area.

Traffic Analysis

Traffic analyses were performed for the intersections within the study area to determine the operation of the existing street system, evaluate the impact of the proposed development, and determine the ability of the existing street system to accommodate projected traffic demands. Analyses were performed for the existing and the projected traffic volumes.

The traffic analyses were performed using Synchro 7 computer software, which is based on the methodologies outlined in the Transportation Research Board's *Highway Capacity Manual (HCM), 2000*. The ability of an intersection to accommodate traffic flow is expressed in terms of level of service, which is assigned a letter grade from A to F based on the average control delay experienced by vehicles passing through the intersection. Control delay is that portion of the total delay attributed to the traffic signal or stop sign control operation and includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. Level of Service A is the highest grade (best traffic flow and least delay), Level of Service E represents saturated or at-capacity conditions, and Level of Service F is the lowest grade (oversaturated conditions, extensive delays). For two-way stop controlled (TWSC) intersections, levels of service are only calculated for the approaches controlled by a stop sign (not for the intersection as a whole).

The *Highway Capacity Manual* definitions for levels of service and the corresponding control delay for signalized intersections and unsignalized intersections are shown in the Appendix. The results of the capacity analysis are summarized in **Table 2** for the existing traffic volumes and **Table 3** for the projected traffic volumes.



PROJECT:
410 EAST GRAND
CHICAGO, ILLINOIS

TITLE:
TOTAL PEAK HOUR VOLUMES

PROJECT NO: II-050

KLOA

FIGURE NO: 8

Table 2
CAPACITY ANALYSIS RESULTS—EXISTING TRAFFIC CONDITIONS

| Intersection | Weekday A.M. Peak Hour | | Weekday P.M. Peak Hour | | Saturday Midday Peak Hour | |
|------------------------------------|---------------------------|-------|---------------------------|-------|------------------------------|-------|
| | LOS | Delay | LOS | Delay | LOS | Delay |
| McClurg Court with Ohio Street | B | 11.0 | B | 11.5 | A | 8.0 |
| McClurg Court with Grand Avenue | B | 13.1 | B | 14.3 | B | 14.7 |
| McClurg Court with Illinois Street | B | 16.3 | C | 21.6 | C | 20.1 |

LOS - Level of Service
Delay - Measured in Seconds

Table 3
CAPACITY ANALYSIS RESULTS—PROJECTED TRAFFIC CONDITIONS

| Intersection | Weekday A.M. Peak Hour | | Weekday P.M. Peak Hour | | Saturday Midday Peak Hour | |
|---|---------------------------|-------|---------------------------|-------|------------------------------|-------|
| | LOS | Delay | LOS | Delay | LOS | Delay |
| McClurg Court with Ohio Street | B | 19.2 | B | 15.3 | B | 11.8 |
| McClurg Court with Grand Avenue | B | 14.7 | B | 15.8 | B | 15.1 |
| McClurg Court with Illinois Street | B | 17.9 | C | 26.6 | C | 23.1 |
| Grand Avenue with Access Drive ¹ | B | 14.1 | B | 12.1 | B | 14.8 |

LOS - Level of Service
Delay - Measured in Seconds
¹Represents operation of the approach under stop sign control.

Evaluation of the Street Operations

The results of the capacity analyses show that all of the intersections in the study area are currently operating at an acceptable level of service. With the addition of the development traffic and the other growth projected in the area, all of the intersections are projected to continue to operate at an acceptable level of service. The capacity analyses indicated that some queuing and delays are currently experienced on some approaches as well as certain individual movements, particularly on the north-south streets. However, field observation and the capacity analyses indicate that the queuing and delays are typically not excessive.

The following outlines several of the factors that are contributing to the less than desirable operation on some approaches under existing conditions.

1. The north-south streets receive a limited amount of green time per signal cycle. This is because Grand Avenue and Illinois Street form a major one-way pair that provide access to/from the regional freeway system. As such, the signal timings at many of the intersections in the study area have been set to facilitate the east-west traffic movement.
2. The close spacing of the east-west streets within the area limits the available stacking (storage) distance between the intersections on the north-south streets. As a result, the queuing that occurs on the north-south streets, which is compounded by the limited green time, occasionally extends beyond mid-block access drives and downstream intersections, which contribute to the congestion and delay experienced during the peak periods at some of the intersection approaches on these streets.
3. Due to the high concentration of pedestrian movements in the area, particularly on weekends, the vehicle capacity of the intersections is limited. Turning vehicles yielding to pedestrian traffic in the crosswalks reduces the capacity of the intersections. It should be noted that the pedestrian and bicycle activity along the Lower Lake Shore Drive corridor will be significantly reduced with the proposed grade separation of the lakefront path over the Chicago River and Lower Lake Shore Drive.

As such, no additional capacity and/or street modifications are required to accommodate the additional traffic to be generated by the development. However, in order to enhance the operation of the Grand Avenue/McClurg Court intersection, it is recommended that the bus stop on the north side of Grand Avenue be relocated from the east (near) side to the west (far) side of the intersection. It is our understanding that the bus stop used to be located on the west (far) side of the intersection, but was relocated to the east (near) side during the construction of the second tower of The Streeter Apartments. Further, the CTA generally prefers far side as opposed to near side bus stops.

Transportation Sustainability Recommendations

The following summarizes measures to be implemented by the development and/or recommendations to further minimize the impact of the development, foster alternative modes of transportation other than the automobile, and to enhance pedestrian/bicycle safety.

- A minimum of 50 bike racks is proposed to be provided within the development.
- The McClurg Court sidewalk is proposed to be widened as part of the development.
- One to two parking spaces within the parking garage should be reserved for car-sharing vehicles.
- The developer is planning to implement the following pedestrian safety improvements.
 - ❖ The Ohio Street/McClurg Court traffic signal should be upgraded with countdown pedestrian signals.

- ❖ The existing crosswalks at the Ohio Street/McClurg Court, Grand Avenue/McClurg Court and Illinois Street/McClurg Court intersections are mostly faded and should be restriped.
- Per the request of CDOT, McClurg Court will be widened to 48 feet along the site frontage in order to accommodate future bike lanes.

Site Access

Access to the parking garage is proposed to be provided via one access drive on Ohio Street and one access drive on Grand Avenue. The following describes the design and locations of the access drives.

- The *Ohio Street access drive* is proposed to be located on the south side of the street along the eastern property line, maximizing the distance between the access drive and McClurg Court. This access drive is proposed to provide inbound only access via a one-lane access drive. Given that Ohio Street is a one-way eastbound street, only inbound right-turn movements will be permitted at this access drive.
- The *Grand Avenue access drive* is proposed to be located on the north side of the street along the eastern property line, maximizing the distance between the access drive and McClurg Court. This access drive is proposed to provide inbound and outbound access via a two-lane access drive. Given that Grand Avenue is a one-way westbound street, only inbound and outbound right-turn movements will be permitted at this access drive. The outbound lane of the access drive should be under stop sign control and warning devices such as flashing lights should also be considered at this access drive.

The provision of the two access drives will provide the development with greater site access flexibility as traffic will be able to directly enter the parking garage from both Ohio Street and Grand Avenue. This is very critical given the one-way nature of Ohio Street and Grand Avenue. As a result, traffic will not have to circle the block when traveling to the development, which will only reduce the impact of the development on the existing street system.

The development is proposing to provide four loading docks that will be located internally within the development. Access to the service area will be provided via a one-way southbound service drive that will extend from Ohio Street south to Grand Avenue. All truck traffic will directly enter via Ohio Street and exit via Grand Avenue and will not have to back into the loading area. As such, the provision of the loading docks within the development and the one-way service drive will substantially minimize any impact that truck traffic will have on the area street system. The Ohio Street access drive is proposed to be located at approximately the middle of the site while the Grand Avenue access drive will be located adjacent to the parking garage access drive. The proximity of the two Grand Avenue access drive will not pose any operational issues given (1) the limited volume of traffic projected to use the access drives, particularly the service drive, (2) that outbound movements are only permitted from the service drive and (3) that Grand Avenue is a one-way westbound street. Lastly, warning devices such as flashing lights should also be considered at the Grand Avenue access drive.

Lastly, a *drop-off/pick-up area* is proposed on the east side of McClurg Court with access provided via two one-way access drives on Grand Avenue. As proposed, the drop-off/pick up area will provide one-way northbound circulation with the southern access drive providing inbound access only and the northern access drive providing outbound only access. Both access drives will provide a one-lane cross section. Lastly, the drop off/pick up area will be able to accommodate approximately three to four vehicles and still provide a lane for circulation. Signs should be posted limiting the usage to drop off and pick up and prohibiting the parking of vehicles.

Conclusion

Based on the preceding analyses and recommendations, the following conclusions have been made.

- Accessibility to and from the area is enhanced by the various alternative modes of transportation serving the area as summarized below. The area is served by the CTA Red (Howard/Dan Ryan) rapid transit line which has a local stop ½ mile from the site. In addition, the five bus routes serve the immediate area and all have stops that are two to three blocks from the site. Lastly, on-street bike lanes are provided along Grand Avenue and Illinois Street providing access to the Lake Front Trail as well as other bicycle streets.
- The amount of new traffic generated by the proposed development will be reduced due to the proximity of development within the downtown area and the alternative modes of transportation serving the area. In addition, not all of the traffic that will be generated will be new since the development is replacing an existing surface parking lot.
- The development-generated traffic can be accommodated efficiently without significant impact to the external street system. All of the intersections within the study limits are projected to operate at acceptable levels of service with the addition of the development generated traffic.
- In order to enhance the operation of the Grand Avenue/McClurg Court intersection, it is recommended that the bus stop on the north side of Grand Avenue be relocated from the east (near) side to the west (far) side of the intersection.
- The developer is planning to install the following pedestrian safety improvements: (1) upgrade the Ohio Street/McClurg Court traffic signal to provide countdown pedestrian signals and (2) restriped the crosswalks at the intersections analyzed.
- The proposed site access system will be adequate to serve the traffic that will be generated by the proposed development. Furthermore, the following aspects of the site access system will significantly mitigate the impact of the development on the external street system.
 - ❖ The provision of the two access drives serving the parking garage will provide the development with greater site access flexibility as traffic will be able to enter the parking garage from both Ohio Street and Grand Avenue.

- ❖ All service loading will occur within the site via four loading docks and will be served via a one-way southbound service drive that will extend from Ohio Street south to Grand Avenue. All truck traffic will enter via Ohio Street and exit via Grand Avenue and not have to back in to the loading docks.
- As part of the development plan, the McClurg Court sidewalk is proposed to be widened and a minimum of 50 bike parking spaces will be provided which will only further promote the use of alternative modes of transportation.

Appendix

LEVEL OF SERVICE CRITERIA—SIGNALIZED INTERSECTIONS

| Level of Service | Interpretation | Delay per Vehicle (seconds) |
|------------------|---|-----------------------------|
| A | Very short delay, with extremely favorable progression. Most vehicles arrive during the green phase and do not stop at all. | ≤ 10.0 |
| B | Good progression, with more vehicles stopping than for Level of Service A, causing higher levels of average delay. | > 10 and ≤ 20.0 |
| C | Light congestion, with individual cycle failures beginning to appear. Number of vehicles stopping is significant at this level though many still pass through the intersection without stopping. | > 20 and ≤ 35 |
| D | Congestion is more noticeable, with longer delays resulting from combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and the proportion of vehicles not stopping declines. | > 35 and ≤ 55 |
| E | High delays result from poor progression, high cycle lengths and high V/C ratios. | > 55 and ≤ 80 |
| F | Unacceptable delay occurring, with oversaturation. | > 80.0 |

LEVEL OF SERVICE CRITERIA—UNSIGNALIZED INTERSECTIONS

| Level of Service | Average Total Delay (SEC/VEH) |
|------------------|-------------------------------|
| A | ≤ 10 |
| B | > 10 and ≤ 15 |
| C | > 15 and ≤ 25 |
| D | > 25 and ≤ 35 |
| E | > 35 and ≤ 50 |
| F | > 50 |

Source: *Highway Capacity Manual*, 2000.